

Assessment of Knowledge and Competences in Agricultural Engineering Acquired by the Senior Secondary School Students for Farm Mechanisation

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Abstract

This study was designed to assess the agricultural engineering knowledge and competencies acquired by the senior secondary students for farm mechanization in technical colleges in Ebonyi state of Nigeria. A survey research design was adopted for the study. Three research questions and two null hypotheses guided the study. The population of the study was 1,858 comprising of 174 teachers and 1,684 final year students. A simple random sampling technique was used to select 370 as sample for the study. A structured questionnaire with 21 items was employed for the study. The instrument was face validated by 3 experts. Two of the experts from the Department of Technology and Vocational education while one specialist from measurement evaluation, all from Ebonyi State University; and the reliability coefficient of 0.183 was obtained using Cronbach alpha technique to determine the internal consistency of the instrument. The data collected were analyzed using weighted mean and standard deviation for the research questions while t-test statistics was used to test for the hypotheses at 0.05 level of significant. The result of the analysis of the data reveals that the students have the knowledge in recognizing and identifying tillage machines, tools and equipment but do not have the competencies in the use of tillage, planting, weeding and harvesting farm machines tools and equipment except the use of simple farm tools like hoe, spade and sickle. The result of the hypotheses showed that there was no significant difference in the opinions of the teachers and the students on the knowledge and the competencies acquired by the senior secondary students in agricultural engineering for farm mechanization. It was recommended among others that the teachers should expose the students more on the practical use of the tillage, planting, weeding and harvesting farm machines, tools and equipment.

Keywords: Knowledge, competences, agricultural engineering, secondary school students

1. Introduction

In Nigeria today, agricultural production is purely subsistence. Farmers use crude implements such as hoes and cutlasses in their farm operations. Under this system of agriculture, farm operations such as land preparation, planting of crops, weeding, harvesting and storage are traditionally carried out.

Furthermore, local seeds of low yielding capacity are used in planting. The control of pests and diseases are locally done by the use of local materials such as wood-ash in treating fungal infections. Farm operations are usually carried out by the use of farm crude tools and equipment, and the use land tenure system still dominate. Hence, Akinsanmi (1988) described farming operations in Nigeria as "Hoe and cutlass farming". This type of traditional technology is uninteresting, laborious, unproductive and unprofitable. It is essentially labour-intensive, largely characterized by trekking of long distances between home and farms. It considerably reduces the man-hours utilized in any specific man-day of farm operations.

Moreover, this traditional system of agriculture is beset by some fundamental problems. First, is the problem of deterioration in the vigour and stability of human labour in a stern environment of high temperatures and humidity. Second, is the problem of low productivity in terms of input-output relationships. The third, is the problem of age-long and inefficient farm management and crop culture techniques found in the various types of framing systems in practice all over the country. The fourth, is the twin problem of the ageing population of framers and the rural-urban drift of able-bodied youths both of which deprive production of required man-days of labour. The fifth, is the set of socio-cultural forces which regulate time allocation profiles in varying forms of rituals, taboo and rites. In addition, under this subsistence agriculture, a small quantity of the agricultural produce is sold with little income accruing to the farmer.

The problems arising from the hoe cutlass culture form part of a large set of problems militating against rapid agrarian development in Nigeria. These problems and the implications for a agrarian development led the government to incorporate agricultural engineering policy into the senior secondary school curriculum in 1977 when the National policy on Education came into operation.

Mccolly and Martin (1955) defined agricultural engineering as the application engineering as the application of any or all branches of engineering to the extent that they may be used in farming, in rural living, rural processing of farm products and such allied activities like environmental control, soil conservation and management of water for agricultural production. Furthermore, agricultural engineering involves the use of modern equipment in farm operations, use of chemicals to control weeds, pests and diseases, use of modern

storage facilities such as silos, refrigerators and cold rooms for storage and preservation of agricultural products. Agricultural engineering covers the area of construction of farm structures, communication systems on the farm, electrification, transportation, processing and marketing of agricultural products.

As a profession, agricultural engineering calls for a knowledge of many other kinds of engineering, such as hydraulic, mechanical and structural engineering. Indeed, agricultural engineering serves the following purposes.

1. It serves as a major resource for creating agricultural wealth.
2. It is an instrument for facilitating mass production.
3. It reduces production cost at the long run by the use of better methods of farming.
4. It reduces drudgery in farm operations, and
5. Little time is spent in farm operations.

Furthermore, Akinsanmi (1988) observed that agricultural engineering enables the farmers to carry out farming operations with relative ease; treat sewage, make efficient utilization of water for cultivation of crops all round the year without waiting for the natural rainfall. The soil and water engineering aspect of agricultural engineering is concerned with soil preparation, reclamation of land, irrigation systems, drainage and management of water in the area of scarcity. The electrical power in the farm has been applied in various ways such as grinding, provision of heat in the poultry farm, in milling machines, pumping of water, lighting, cooling and processing.

The farm structure and environmental control aspect of agricultural engineering deals with farm structures, control of pollutions and waste management on the farm.

The major aim of the introduction of agricultural engineering into the senior secondary school agricultural science curriculum was to develop scientific knowledge and practical and applied skills in agricultural engineering in the students (WAEC, 1996). The specific objectives of agricultural engineering at the senior secondary level are as follows:

- (a) To expose the students to the knowledge and competencies in planting, tillage, weeding and harvesting farm machines, tools and equipment.
- (b) To inculcate in the youths the merits and demerits of different sources of farm power;
- (c) To provide the skills in maintenance of farm machines, tools and equipment in the students;
- (d) To provide the knowledge and competencies needed in farm surveying, the skills and use of surveying.
- (e) To provide the knowledge and the principles of farmstead outlay (P.G.N., 1985).

These objectives can only be achieved through the development of the scientific knowledge and practical and applied skills in agricultural engineering. Simpson and Weiner (1991) define knowledge as the intellectual instance with or perception of facts. They hold the opinion that knowledge is the theoretical or practical understanding of an art, science and industries.

Knowledge involves the ability to recognize, perceive distinguish. On the other hand, Hull (1972) conceptualized skill as manual dexterity through the repetitive performance of an act. Okorie and Ezeji (1988) remarked that, to possess a skill is to demonstrate the habit of acting, thinking or behaving in a specific activity which has become so natural to the individual through repetition or practice that it may become automatic.

Similarly, a skilled operator is a person competent to perform, to operate a machine with high degree of expertness or to work in one or more specified divisions of a given trade. Many authors have been attracted by the concept of skill, as such many definitions have been given to skill. One common feature of all the definitions is that skill deals with the acquisition of Performa ability which enables a skilled individual to be at most economic level.

The required knowledge and perform skills in agricultural engineering at senior secondary school include, the knowledge to recognize and identify, farm machines, farm tools and equipment and the ability to use the farm machines, tools and equipment to carry out certain farm activities and as well maintain the machines, tools and the equipment.

In fact, experience has shown that the students lack the required skills in agricultural engineering. Okorie (1975) observed that secondary school students still use local farming implements such as hoes and matches in cultivating approximately ten hectares of rice, maize, cassava and vegetables. Similarly, it has been observed that agricultural operations in the schools is still being identified with traditional systems of agricultural practices without the application of agricultural engineering knowledge and skills.

It is against this background that it has become necessary to assess the agricultural engineering knowledge and skills possessed by the senior secondary, school students of Agricultural Science for farm mechanization.

2. Statement of the Problem

Realizing the importance of mechanized agriculture in relation to agricultural productivity, the national curriculum for senior secondary school emphasizes the development of scientific knowledge and practical skills

in agricultural engineering by the agricultural science students for mechanized agriculture. Despite the emphasis, experience has shown that students lack the required scientific knowledge and practical skills in agricultural engineering for mechanized agriculture. The students still use obsolete and traditional equipment in school farm practices. The students still carry out land preparation planting crops, weeding and harvesting with crude implements. Similarly, pests and diseases control as well as preservation and storage of farm products are being carried out traditionally. These traditional methods are time consuming, uninteresting, laborious, unproductive and unprofitable. All these are indications that the agriculture engineering knowledge and skills are still lacking in the students. It is on this basis that this study was designed to assess the agricultural engineering knowledge and skills possessed by the senior secondary students for farm mechanization agriculture in Ebonyi Technical colleges, Nigeria.

3. Purpose of the study

The main purpose of this study is to assess the knowledge and skills in agricultural engineering possessed by the senior secondary students for farm mechanization. Specifically, the study sought to:

1. Determines the knowledge acquired by the students in identifying tilling farm tools and equipment for farm operation.
2. Determine the knowledge acquired by the students in identifying planting weeding and harvesting machines, tillage tools and equipment for farm operations.
3. Determine the competencies acquired by the students in the use of tillage, planting, weeding and harvesting farm machines tools and equipment for farm operations.

4. Research Questions

- 1 What are the knowledge acquired by the senior secondary school students in identifying tillage farm machines, tools and equipment for farm operations?
- 2 What are the knowledge acquired by the senior secondary school students in identification of planting, weeding, and harvesting farm machines, tools and equipment for farm operations?
- 3 Determine the competencies acquired by the senior secondary school students in the use of tillage, planting, weeding, and harvesting farm machines, tools and equipment for farm operations.

5. Hypothesis

The following hypotheses guided the study.

HO₁: There will be no significant difference between the mean ratings of the students and the teachers on the knowledge the students acquired in identifying tillage machines, tools and equipment for farm operations.

HO₂: There will be no significant difference between the mean ratings of the students and the teachers on the competencies acquired by the students in the use of tillage, planting, weeding and harvesting machines, tools and equipment for farm operations.

6. Methodology

This study adopted survey research design, and was carried out in technical colleges in Ebonyi State of Nigeria. Ebonyi State has its capital territory at Abakaliki. The state is bounded in the north with Benue State, East with Cross River State, in the South with Abia State and West with Enugu State. The state has 4 technical colleges and many other non- technical secondary schools. The population of the study was 1858. it comprised of 174 teachers and 1,684 senior secondary school students. Then 370 were randomly selected and was used as the sample of the study. The instrument used for data collection was a structured questionnaire. The questionnaire had a 4 points rating scale of Highly Acquired (HA), Averagely Acquired (AC), Acquired and Not- Acquired (NA). The instrument was validated by 3 experts in Education, 2 experts from the Department of Technology and Vocational Education in Ebonyi State University and one specialist in measurement and evaluation in the same university. The Questionnaire had 21 items. The validity and reliability of the instrument was determined by using cronbach alpha to determine the internal consistence of the items which yielded a reliability coefficient of 0.83. The data were collected with the help of three research assistants who were trained by the researcher. Out of the 370 questionnaires distributed, 362 were retrieved which represents 97.8%. The data collected were analyzed using mean statistics and t- test was used to test the hypothesis formulated at 0.05 level of significance.

In answering the research questions, any item with a mean (\bar{x}) score of 2.50 was regarded as the knowledge and the skills required while any item with the mean score of less than 2.50 was regarded not knowledge and skills required. In testing the hypothesis, any item whose t- calculated was less than the t- critical, the null Hypothesis was accepted any item whose t-cal was greater than the t- critical, the null Hypothesis was rejected at the 0.05 level of significance.

7. Results and Discussions

Research Question1: what are the knowledge acquired by the senior seco0ndry students in identifying tillage farm machines, tools and equipment for farm operations?

Table 1: Mean rating scores of the respondents on the knowledge of identifying tillage farm machines, tools and equipment for farm operations.

S/N	Item Statements	\bar{x}	SD	Remarks
1.	Identification of mouldboard plough	3.34	0.78	Acquired
2.	Recognition of Disc-plough	3.18	0.88	Acquired
3.	Recognition of Disc-Harrow	3.37	0.77	Acquired
4.	Recognition Of Disc-Ridge	3.09	0.88	Acquired
5.	Identification of point of linkage on the farm machine	3.29	0.78	Acquired
6.	Recognition of hoe, spade and digger	3.59	0.68	Acquired

The data in table 1 reveals that all the items had their mean scores above the cutoff point of 2.50. This signifies that the senior secondary students have the knowledge to identify and recognize tillage machines, tools and equipment for farm operations.

Research Question 2: What are the knowledge acquired by the senior secondary students in identification of planting, weeding and harvesting farm machines, tools and equipment for farm operations?

Table 2: Mean ratings of the Respondents on knowledge of identification and Recognition of planting, weeding and harvesting farm machines, tools and equipment.

S/N	Item Statements	\bar{x}	SD	Remarks
1.	Recognition of seed drilling machine	2.63	1.03	Acquired
2.	Identification of tractor coupled equipment for broadcasting seeds	2.95	1.08	Acquired
3.	Identification of knapsack sprayer for spreading chemical herbicides for weed control	3.98	0.92	Acquired
4.	Identification of boom-sprayer for tractor spraying chemicals to control weeds	2.09	1.00	Not Acquired
5.	Recognition of harvesters	1.78	0.85	Not Acquired
6.	Recognition of harvesting tools like sickles, go-to-hell	3.13	0.93	Acquired
7.	Identification of hoe and hand trowel as tools for weeding	3.89	0.85	Acquired

The data in table 2 shows that items 1, 2, 3, 6 and 7 had their mean scores above the cutoff point 42.50 with their basic corresponding standard deviations while item 4 had its score less than 2.50, this implies that the respondents agreed that the students acquired the knowledge of tillage, weeding and harvesting farm machines, tools and equipment except, the knowledge of boom sprayer for spraying chemicals for weed control on the farm.

Research Question 3: What are the competences acquired by the students in the use of tillage, planting, weeding and harvesting machine tools and equipment for farm operation?

Mean ratings of the Respondents on the competences in the use of tillage, planting weeding and harvesting tools and equipment for farm operations.

S/N	Competencies in the use of planting, weeding and harvesting machines	\bar{x}	SD	Remarks
	Ability to;	1.68	0.84	Not Acquired
1.	operate tractor to plough the farm for planting of crops	1.89	0.85	Not Acquired
2.	use the tractor to harrow the ploughed field	2.11	0.76	Not Acquired
3.	use the tractor to make ridges on the farm	2.00	0.78	Not Acquired
5.	Operate the knapsack sprayer to sprayer herbicides to control weeds on the farm.	1.79	0.90	Not Acquired
6.	Operate the tractor to broadcast seeds on the farm	2.25	0.76	Not Acquired
7.	operate the harvester to harvest some crops on the farm	3.60	0.70	Not Acquired

The table on table 3 reveals that all the items had their mean scores less than 2.50, which is the cut-off point. This implies that the respondents agreed that the students are not acquire the competences in the use of the tillage, planting, weeding and harvesting machines, tools and equipment but they acquire only the competent in the use of tools like hoe, spade and other simple farm tools to till the soil and plant crops and harvest crops.

Hypothesis

H₀1: There will be no significant difference between the mean ratings of the teachers and the students on the knowledge of tillage machines, tools and equipment acquired by the senior secondary students for farm operations.

Table 4: t-test analysis on the mean Responses of Respondents on the knowledge acquired by the senior secondary students on tillage machines, tools and equipment for farm operations.

S/N	Item Statement	students' X	Teachers' X	t _{cal}	t _{tab}	Remarks
1.	Identification of mouldboard plough	3.02	—	0.40	1.96	*
2.	Recognition of Disc-plough	3.30	3.26	0.40	1.96	*
3.	Recognition of Disc-Harrow	3.02	3.13	-1.10	1.96	*
4.	Recognition Of Disc-Ridge	3.25	3.05	0.70	1.96	*
5.	Identification of point of linkage on the farm machine	3.08	3.28	-2.00	1.99	*

N₁ = 332

N₂ = 30

df = 360

* = No significant difference

**= significant difference

The data in table 4 shows that all the items had their t-calculated less than t-critical of the 1.96, therefore, the null hypothesis was accepted. This means that there was no significant difference between the responses of the teachers and the students on the tillage machines, tools and equipment for farm operations.

H₀2: There will be no significant difference between the mean ratings of the Respondents on the competences acquired by the senior secondary school students on the use of tillage, planting, weeding and harvesting farm machines tools and equipment for farm operations.

Table 5: t-test analysis on the mean Ratings of the Respondents on competencies acquired by the senior secondary school students in the use of tillage, planting, weeding and harvesting machines, tools and equipment.

S/N	Item Statement	students' (X)	Teachers' (X)	t _{cal}	t _{tab}	Remarks
1.	Ability to; operate tractor to plough the farm for planting of crops	1.68	1.67	0.05	1.96	*
2.	use the tractor to harrow the ploughed field	1.89	1.88	-0.06	1.96	*
3.	use the tractor to make ridges on the farm	2.10	2.12	0.01	1.96	*
4.	use boom-sprayer to spray chemicals to control weeds on the farm	2.00	2.01	0.12	1.96	*
5.	operate the knapsack spray to sprayer herbicides to control weeds on the farm.	1.98	1.99	-0.24	1.96	*
6.	operate the tractor to broadcast seeds on the farm	2.02	2.01	-0.01	1.96	*
7.	operate the harvester to harvest some crops on the farm	2.25	2.26	0.23	1.96	*
8.	use hoes, spade, sickle to till the soil, plant crops and harvest	3.59	2.58	-0.31	1.96	*

N₁ = 332

N₂ = 30

* = No significant different

The data in table 5 reveals that all the items had that t-calculated less than the t-table. Therefore, the null hypothesis was accepted. This implies that the opinions of the teachers did not differ from the students significantly on competencies acquired by the students in tillage, planting, weeding and harvesting farm machines, tools and equipment for farm operations.

8. Findings

Based on the analysis of the data, the following results emanated;

1. The senior secondary school students in Technical colleges in Ebonyi State have the knowledge in identification and recognition of tillage, farm machines, tools and equipments for farm operations.
2. The students have the knowledge of identifying and recognizing planting, weeding and harvesting farm machines, tools and equipment for farm operations.
3. The students have not acquired the competencies in the use of farm machines excepts in the use of simple farm tools such as hoe, spade and sickle in tilling the soil, weeding and harvesting of farm products.
4. There was no significant difference between the opinions of the teachers and the students on the knowledge and competencies acquired by the senior secondary students in tillage machines, tools and equipments for farm operations.
5. The opinions of the teachers and the students did not differ on the competencies acquired by the students in the use of tillage, planting, weeding and harvesting farm machines for, tools and equipment for farm operations

9. Discussion of Findings

The findings of this study reveals that the senior secondary school students have the knowledge of tillage machines, tools and equipment. This finding is in line with Olaitan (1996) who reported that the secondary school graduates must at least acquire the basic knowledge in farm machines such as identification of different farm tractors, and the tractor coupled implements. The findings also shows that the senior secondary school students have acquired the knowledge of recognizing and identifying planting, weeding and harvesting farm machines, tools and equipment. This finding is in agreement with Eze (2006) who reported that the students of Agricultural science in the secondary school should have knowledge of tools and equipments based on their functions in farm activities.

Additionally, the researcher revealed that senior secondary school students do not have the competencies to operate tillage, planting, weeding and harvesting farm machines but are competent in the use of simple tools and equipments. This result is in agreement with Okorie (2000) who reported that the competency in the operation of some farm machines by secondary school graduates has not been achieved in Nigeria due to lack of exposure of the students to the use of such machines at the secondary school levels.

10. Conclusion

The problem of food scarcity in Nigeria to a large extent could be solved through farm mechanization. Mechanized agriculture itself can only be achieved only if there are trained, knowledgeable and competent manpower in the agricultural engineering. The Federal government of Nigeria has made tremendous efforts to boost food production through many programmes and projects among them was the introduction of Agro-auto-mobile under agricultural engineering in the technical colleges. This course is aimed at developing the basic knowledge agricultural engineering and competences in the use of tillage, planting, weeding and harvesting machines, tools and equipment for farm operation. The graduates of technical colleges are expected to possess the knowledge and competencies in identifying, recognizing and operation of that basic farm machines, tools and equipments. This study have found that students of technical colleges in Ebonyi State have got the knowledge of tillage, planting, weeding and harvesting machines, tools and equipment but lack the competencies in the use and operation of the tillage, planting, weeding and harvesting of farm machines, tools and equipment.

11. Recommendations

Based on the findings, it is recommended that;

1. The teachers should ensure that students of agricultural science in the technical colleges are better exposed on the practical skills in the operation of the simple farm machines.
2. Senior secondary students should be trained by the teachers on the use of tillage, planting, weeding and harvesting farm machines, tools and equipment.
3. Students at the senior secondary schools should be taken out for excursion tour to well mechanized farm where the students will acquire practical experience in the operation and the use of simple farm machines, tools and equipment.

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